What is claimed is:

1. An improved echo control system of the type including:

an echo-containing near signal input;

an echo canceller, coupled to a far signal reference, producing an echo estimate
signal output representative of the echo contained in the near signal;

a signal coupling node, coupled to the near signal input and the echo estimate
signal output, producing an echo-canceled signal output having an echo
residue;

an echo shaping filter, coupled to the echo-canceled signal output, reducing the
echo residue and providing an echo-suppressed signal output, the echo
shaping filter having a spectral response determined by filter coefficients;
and

a background filter, coupled to:

(a)   an error signal representative of the difference between:

(i)   the echo canceled signal, and

(ii)   a signal representative of background filter spectral response, and

(b)   an adaptive control module producing a reference signal output that is a
weighted sum of:

(i)   the echo-containing signal, and

(ii)   the echo canceled signal,

the background filter updating the filter coefficients of the echo shaping filter
responsive to a normalized least mean square (NLMS) algorithm;

wherein the improvement comprises:

determining, in the adaptive control module, a reference signal weight for the
weighted sum, the weight being proportional to the far signal reference;

and an estimate of the norm of an echo canceller error vector, and inversely proportional to an estimate of a residue of the echo canceller; and

using a non-linear normalized convergence term in the NLMS algorithm.

2.   An improved echo control system according to claim 1, wherein the echo canceller is a finite impulse response (FIR) filter.

3.   An improved echo control system according to claim 1, wherein the echo shaping filter is a finite impulse response (FIR) filter.

4.   An improved echo control system according to claim 1, wherein the background filter is a finite impulse response (FIR) filter.

5.   An improved echo control system according to claim 1, wherein the echo canceller error vector is determined as:

$$\Delta w(k) = \mathbf{w}_{ep} - \mathbf{w}(k)$$

where $\Delta w(k)$ represents the echo canceller error vector, $\mathbf{w}_{ep}$ represents a physical echo path identified by the echo canceller, and $\mathbf{w}(k)$ the echo canceller response.

6.   An improved echo control system according to claim 1, wherein the reference signal weight is determined as:

$$\alpha(k) = \frac{\beta \, \|\Delta \mathbf{w}(k)\| \bar{x}_s(k)}{\bar{e}_s(k)}$$

where $\alpha(k)$ represents the reference signal weight, β represents a constant normalizing term, $\|\Delta \mathbf{w}(k)\|$ represents an estimate of the norm of the echo canceller error vector,

$\bar{x}_s(k)$ represents a short-term average magnitude of the far signal reference, and $\bar{e}_s(k)$ represents a short-term average magnitude of the echo canceller residue.

7. An improved echo control system according to claim 6, wherein the echo canceller error vector is determined as:

$$\frac{N + N_T}{N_T} \sum_{i=1}^{N_T} |w_i(k)|$$

8. An improved echo control system according to claim 1, wherein the NLMS update algorithm is:

$$\mathbf{h}(k+1) = \mathbf{h}(k) + \frac{\mu}{\zeta + \mathbf{z}(k)^T \mathbf{z}(k)} \mathbf{z}(k) e_h(k)$$

where $\mathbf{h}(k)$ represents the echo shaping filter having an order L_H, $\mathbf{z}(k)$ represents a vector representing the L_H most recent values of the reference signal output, $e_h(k)$ represents the error signal, ζ represents a non-negative constant, and $\dfrac{\mu}{\zeta + \mathbf{z}(k)^T \mathbf{z}(k)}$ represents a normalized convergence coefficient.

9. An improved method of echo control of the type including:

providing an echo-containing near signal input;

producing, with an echo canceller coupled to a far signal reference, an echo estimate signal output representative of the echo contained in the near signal;

producing, with a signal coupling node coupled to the near signal input and the echo estimate signal output, an echo-canceled signal output having an echo residue;

reducing, with an echo shaping filter coupled to the echo-canceled signal output,
the echo residue and providing an echo-suppressed signal output, the
echo shaping filter having a spectral response determined by filter
coefficients; and

providing a background filter, coupled to:

(a) an error signal representative of the difference between:

    (i) the echo canceled signal, and

    (ii) a signal representative of back ground filter spectral response, and

(b) an adaptive control module producing a reference signal output that is a
weighted sum of:

    (i) the echo-containing signal, and

    (ii) the echo canceled signal,

    the background filter updating the filter coefficients of the echo shaping
filter responsive to a normalized least mean square (NLMS) algorithm;

wherein the improvement comprises:

determining, in the adaptive control module, a reference signal weight for the
weighted sum, the weight being proportional to the far signal reference;
and an estimate of the norm of an echo canceller error vector, and
inversely proportional to an estimate of a residue of the echo canceller;
and

using a non-linear normalized convergence term in the NLMS algorithm.

10. An improved echo control method according to claim 1, wherein the echo
canceller is a finite impulse response (FIR) filter.

11.   An improved echo control method according to claim 1, wherein the echo shaping filter is a finite impulse response (FIR) filter.

12.   An improved echo control method according to claim 1, wherein the background filter is a finite impulse response (FIR) filter.

13.   An improved echo control method according to claim 1, wherein the echo canceller error vector is determined as:

$$\Delta w(k) = \mathbf{w}_{ep} - \mathbf{w}(k)$$

where $\Delta w(k)$ represents the echo canceller error vector, $\mathbf{w}_{ep}$ represents a physical echo path identified by the echo canceller, and $\mathbf{w}(k)$ the echo canceller response.

14.   An improved echo control method according to claim 1, wherein the reference signal weight is determined as:

$$\alpha(k) = \frac{\beta \, \|\Delta \mathbf{w}(k)\| \bar{x}_s(k)}{\bar{e}_s(k)}$$

where $\alpha(k)$ represents the reference signal weight, β represents a constant normalizing term, $\|\Delta \mathbf{w}(k)\|$ represents an estimate of the norm of the echo canceller error vector, $\bar{x}_s(k)$ represents a short-term average magnitude of the far signal reference, and $\bar{e}_s(k)$ represents a short-term average magnitude of the echo canceller residue.

15.   An improved echo control method according to claim 6, wherein the echo canceller error vector is determined as:

$$\frac{N + N_T}{N_T} \sum_{i=1}^{N_T} |w_i(k)|$$

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16.   An improved echo control method according to claim 1, wherein the NLMS update algorithm is:

$$\mathbf{h}(k+1) = \mathbf{h}(k) + \frac{\mu}{\zeta + \mathbf{z}(k)^T \mathbf{z}(k)} \mathbf{z}(k)e_h(k)$$

where $\mathbf{h}(k)$ represents the echo shaping filter having an order L_H, $\mathbf{z}(k)$ represents a vector representing the L_H most recent values of the reference signal output, $e_h(k)$ represents the error signal, ζ represents a non-negative constant, and

$\dfrac{\mu}{\zeta + \mathbf{z}(k)^T \mathbf{z}(k)}$ represents a normalized convergence coefficient.